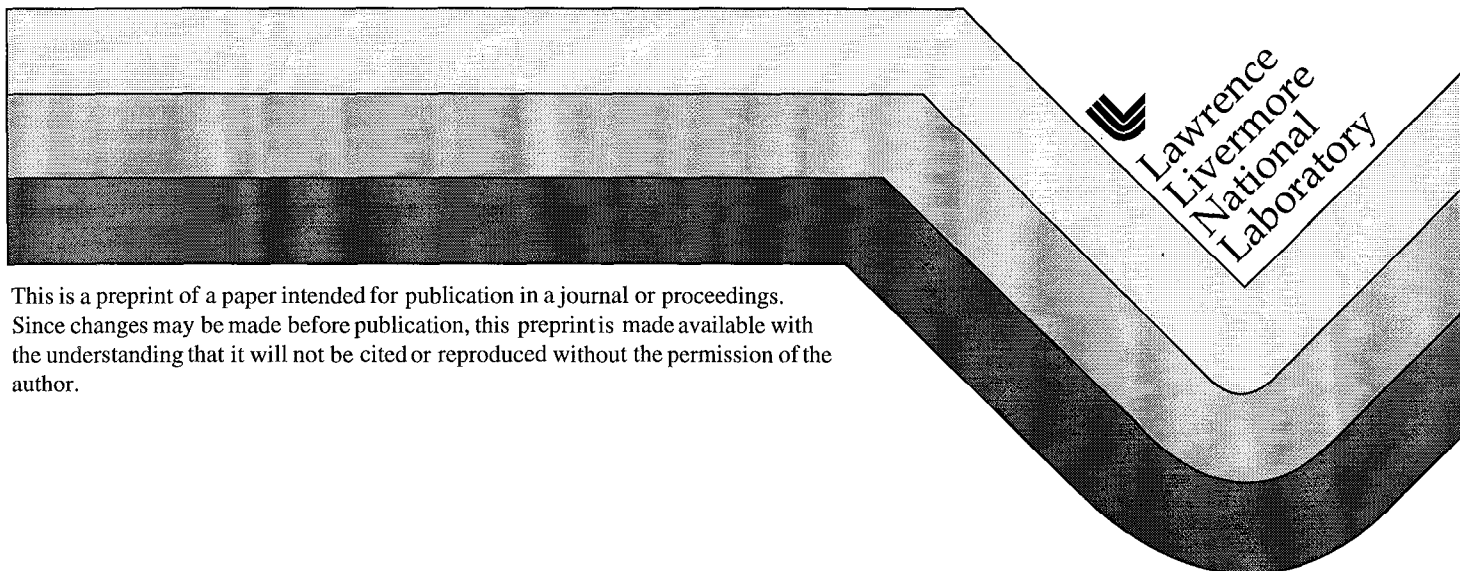


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## **Progress and Future Plans for MPC&A at Chelyabinsk-70**

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### **ABSTRACT**

This paper describes that portion of the Nuclear Materials Protection, Control, and Accounting (MPC&A) program that is directed specifically to the needs of the All Russian Scientific Research Institute of Technical Physics (VNIITF), also called Chelyabinsk-70. Chelyabinsk-70 is located in the Ural Mountains, approximately 2000 km east of Moscow and 100 km south of Ekaterinburg. The MPC&A work that has been completed, is underway and planned at the facility will be described.

During the first two years of the VNIITF project, emphasis was on the Pulse Research Reactor Facility (PRR), which contains one metal and two liquid pulse reactors and associated nuclear material storage rooms and a control center. A commissioning of the PRR was held in May of 1998.

With the completion of the MPC&A work in the PRR, new physical protection work is focusing on other areas. VNIITF-wide physical protection initiatives underway include access control and computerized badging systems, and a central MPC&A control system. Measured physical inventory taking is a high priority for the VNIITF Project Team. A VNIITF-wide computerized accounting system is also being developed for the large and diverse inventory of nuclear material subject to MPC&A.

### **INTRODUCTION**

The work described in this paper is part of an effort called the Nuclear Materials Protection, Control, and Accounting (MPC&A) Program which was created in response to a DOE directive to the national laboratories to develop a cooperative program between the US. and Russian institutes in the area of nuclear materials non-proliferation. The objective of the program is to reduce the risk of nuclear proliferation by strengthening MPC&A systems at Russian nuclear facilities. More specifically the MPC&A program is attempting to make rapid improvements in the protection, control, and accounting of nuclear material, especially weapons-grade materials such as separated plutonium and highly enriched uranium, by having the US laboratories and Russian institutes and other nuclear facilities work directly and cooperatively with each other.

This paper describes that portion of the MPC&A program that is directed specifically to the needs of All Russian Scientific Research Institute of Technical Physics (VNIITF), also called Chelyabinsk-70, which is located inside the closed city of Snezhinsk. VNIITF was established in 1955 as a second nuclear weapons design institute for competition and peer review of the initial Russian nuclear design institute at Arzamas-16. The site contains a number of research facilities which use nuclear material, i.e. plutonium and highly enriched uranium (HEU), as well as assembly, disassembly, and testing of prototypes (pilot samples) of nuclear weapons. Chelyabinsk-70 is located in the Ural Mountains, approximately 2000 km east of Moscow and 100 km south of Ekaterinburg.

## **HISTORICAL BACKGROUND OF VNIITF SECURITY**

The physical security program at VNIITF was designed at a time when the former Soviet Union emphasized more strict control over individuals. Russia is now in a very different situation, where their diversification activities are resulting in an influx of business and industrial people whose reliability cannot be guaranteed through personnel screening. These changes in addition to the economic difficulties there have caused VNIITF to modify its security systems to apply to this different situation.

VNIITF began modernizing its security system in 1993, at the direction of MinAtom. At that time, a specific program was created with emphasis on MPC&A. People from separate laboratories within VNIITF were brought together to work on the enhanced MPC&A program. MinAtom approved the program, however, VNIITF has not received additional money to implement this program. Lack of money therefore limited the rate of progress.

In the first two years of the VNIITF project, emphasis was on the Pulse Research Reactor Facility (PRR), with some work being done which is applicable at the entire VNIITF site. Several collaboration tasks required to implement a comprehensive enhanced MPC&A system at VNIITF were also undertaken. The tasks were prioritized to form a planned approach beginning with a site characterization study and analysis of the existing system followed by system design and installation.

US and Russian personnel shared safeguards and security Vulnerability Assessment (VA) techniques and approaches and obtained some early results by actually applying them to an existing building at VNIITF. This effort included a two-week Vulnerability Assessment workshop conducted jointly by LLNL and SNL at VNIITF.

VNIITF has identified the remaining buildings for which MPC&A upgrades will be needed as part of an "Institute-Wide Study of Nuclear Material Protection Control & Accounting Requirements."

## **COMMISSIONING / DEMONSTRATION**

In May, 1998 DOE Under Secretary Moniz participated in a major milestone at VNIITF, the Commissioning of the PRR, which was selected for initial MPC&A improvements. The PRR contains one metal and two liquid pulse reactors and associated nuclear material storage rooms in buildings 711 and 712, and a control center in building 713, at the Experimental Physics area, also called Site 20. The commissioning included all physical protection systems, including an alarmed perimeter fence, and alarm center as well as nuclear material measurement and computerized accounting systems. After the Commissioning VNIITF held a formal demonstration of the improvements for several other Russian nuclear facility representatives.

Typical upgrades at the three buildings in the PRR included the installation of hardened doors at all entrances and metal grillwork on all first and second floor windows. The reactor and reactor control room doors were replaced with hardened doors. Door contact sensors were placed at a number of key locations and at all entrances to the buildings. A vibration sensor was wrapped around the building's exterior and connected to the metal grillwork over the windows. Microwave, capacitance sensors, and video cameras were installed at various locations in and outside of this building. Access control consists of a combination of a booth with card and hand geometry readers. A telephone unit and metal detector are installed at the main entrance to one building, with additional telephone units located at key points throughout the building.

A Physical Protection Control Station was also installed in the PRR. The VNIITF MARS-90 system processes all alarms and video assessment from the three PRR buildings.

Nuclear measurement, and computerized accounting systems were demonstrated. These included integrated barcode and scales systems. Tamper Indicator Device (TID) procedures were also demonstrated.

## **PHYSICAL PROTECTION**

Since the commissioning of the MPC&A upgrades in the PRR, new physical protection work is focusing on other areas, both inside Site 20, and at other locations. The newer facilities are more sensitive and require modified methods for assuring that the agreed to work is completed. These include the use of video, photographs and certifications. Physical protection upgrades have started at one building within Site 20, which contains another pulse reactor and critical mass stand and nuclear material storage rooms and at two production buildings at other technical areas. Physical protection upgrade design is underway at another building called the Research Technological Center (RTC), located in Site 20.

Physical Protection activities include barriers, intrusion detection, video assessment, access control upgrades, and control station implementation.

VNIITF-wide physical protection initiatives include access control and computerized badging systems, and a central MPC&A control system. The access control system is now being expanded beyond the PRR. All of the access control systems will be integrated into a central control station, which is being designed. The computerized badging system is operating and badges are being made for all regular site employees.

A major new initiative being considered is the construction of a new Nuclear Material Storage Building, which if completed, would replace three existing storage buildings. The construction would take place over a period of 3-4 years, with a design and site preparation planned to occur during the coming year. This building would consolidate nuclear materials in a new structure and enhance the protection of the nuclear material.

The limited access to most areas of VNIITF has posed problems in determining physical protection needs, designing physical protection systems, and obtaining assurance that work has been completed according to contractual agreements. Guidelines for MPC&A upgrades at Russian facilities have now been provided by DOE and our existing agreements are being assessed with this guidance in mind.

## **MATERIAL CONTROL AND ACCOUNTING**

The Project Team has accelerated the performance of measured physical inventories of nuclear materials. Such inventories are underway in buildings 711 and 712 and are planned for the other nuclear facilities. A VNIITF-wide computerized accounting system is being developed for the large and diverse inventory of nuclear material subject to MPC&A. Initial activities of the task included development of a detailed design for some of the material balance areas (MBAs) and characterization of nuclear material handling at VNIITF. Current activities intended to complete the system involve the integration of up to eight data bases, including those for standards and regulations, transportation of nuclear material, MBA descriptions, nuclear materials, communications, information log, etc. The final system will involve further division of MBAs (for a total of 25 to 30). Six additional work stations will be added so that administrators can access on-line MC&A information and analyze inventory discrepancies. Current activities will also involve a) system optimization; b) integration of new measurement equipment, i.e., NDA, balances, passporting, etc.; c) integration of physical protection systems; and d) increasing the number of workstations and servers.

The nuclear material computerized accounting system is based on a prototype developed under an earlier MPC&A contract. This prototype has been expanded to meet more general requirements (e.g., the introduction of bar-code technology) and will be introduced within selected MBAs. The accounting system is based on the commercial Oracle data base, but VNIITF has introduced custom aspects into the system design. Additionally, VNIITF computer scientists have incorporated some of the LANL-developed CoreMAS concepts (designs, capabilities, algorithms, etc.) into their Oracle-based system.

A VNIITF-wide MPC&A telecommunications network system is being developed to organize a single communication medium that integrates computational and information resources of the VNIITF system for computerized accountability of nuclear materials. This communications backbone will

create a main communications channel between covered sites at VNIITF. A central control station will be linked to individual site control stations, which in turn will connect to specific MBAs. The network is designed to allow new elements to be easily introduced into the accounting system and to accommodate upgrades to the communications channels. Additionally, the network can be used for data exchange by other subsystems of the VNIITF MPC&A system. The network will establish reliable and protected communications channels between buildings and sites where computers and equipment of centralized accounting of nuclear materials will be located. Provision is also made for a protected information connection between this network and the nuclear material accountability network of MinAtom.

A scale and weight measurement control program is being implemented at VNIITF for safeguarding nuclear materials at selected facilities. The program has three major components: 1) selection and procurement of appropriate weight measurement equipment; 2) interface of the weight measurement equipment with the barcode equipment used to identify/label material being weighed; and 3) development and implementation of operational procedures and protocols including necessary quality control. The measurement equipment includes 53 scales, weight standards for calibrating the scales, and all necessary electronic equipment to interface output of the scales to the MC&A computer system. All measurement equipment has been delivered to VNIITF. VNIITF is now in the process of installing the scales and interfacing the scales with the computer stations set up for inventory control stations (described later in this paper).

Because of the extensive quantities of special nuclear material at VNIITF, an Active Well Coincidence Counter (AWCC) is required to assay the nuclear material in a variety of physical and chemical forms as used and stored at VNIITF. Such measurements are necessary in preparation for placing the nuclear material under inventory. Desirable attributes of the installed AWCC measurement system will be rapid detection and identification of the fissile inventory in variable background environments, without opening storage containers. The AWCC being tested at VNIITF is a new design built by Aspect, in Dubna, Russia. The AWCC neutron assay system is designed to complement gamma ray spectrometric techniques for determining the isotopic composition of nuclear material. The AWCC has been installed, tested, and is currently being used in physical inventories.

Bar code technologies and rapid Inventory confirmation systems have been introduced at VNIITF in an effort to establish effective nuclear material inventory controls. Bar code readers and computers have been purchased and transferred to VNIITF to establish effective inventory control stations for 18 MBAs. Future plans call for the establishment of additional control stations at 15 MBAs. The bar code readers and rapid inventory confirmation systems ensure that HEU and Pu storage containers have been properly identified and inventoried and can be accurately tracked from one area to another.

Vehicle and pedestrian portal monitor technologies were introduced to VNIITF early in the program in an effort to establish an effective method for the detection of unauthorized movement of special nuclear material (SNM). Portal monitoring is an important tool used to detect concealed SNM as persons or vehicles pass through facility checkpoints or gates. Numerous monitors are currently in operation at several key locations within the VNIITF complex.

Metal detectors are being incorporated at selected VNIITF locations. These provide an additional component to a comprehensive MPC&A System. Under this effort VNIITF has assessed the requirements for detection, determined locations and placements of the detectors, and developed the appropriate operational/maintenance/training procedures. VNIITF accepted delivery in late December 1998 for 7 interior walk-through portal metal detectors, 3 exterior (weatherized) walk-through portal metal detectors, and 15 hand-held metal detectors. VNIITF is now installing the portal detectors and preparing a final report on their use.

VNIITF is implementing a TID program across the entire institute. They have defined their general requirements for TIDs, which include: (1) a unique serial number, (2) a facility identifier, and (3) a bar code, if possible. VNIITF received over 30,000 seals last year, in a combination of E-Cup, Multi-Lok, Cable Lock, vinyl, and mylar types. VNIITF is now in the process of implementing their TID program and is preparing a report on the implementation.

VNIITF is developing a network of four U.S. and eight Russian hand geometry units for a prototype access recognition/control system at the PRR. Performance of the U. S. units and the

Russian prototype unit last year found that the Russian unit met all performance requirements. VNIITF has received all necessary components to construct the eight units and is now in the process of fabricating them and deploying them in their access network.

Part of the MPC&A program at VNIITF is the development of a radio communications system to cover the areas of operation where materials are stored and transported. The trunking radio communications system is now being deployed. The primary purpose of the radio communications system is to improve security and protection of nuclear materials by (1) reducing the response time for security threats, (2) improving communications between site and protective forces, and (3) providing redundancy for critical communications.

## **INFRASTRUCTURE**

Certain tasks at VNIITF are designed to develop the infrastructure and improve the sustainability of the MPC&A program. VNIITF personnel have participated in over twenty training classes and workshops, including a computerized MC&A seminar held by VNIITF for the benefit for five other Russian nuclear facilities. The major purpose of the seminar was to develop draft MC&A system and network requirements, initial system designs, and a strategy for further work that would result in implemented systems at each facility while taking into consideration quantities, forms and processing of the nuclear materials at those facilities. It is planned that VNIITF will develop a comprehensive training program under a MPC&A task for next year.

An internal review and assessment program is being developed under an MPC&A contract at VNIITF to allow VNIITF management to have an independent capability to assess their nuclear material protection, control and accounting program.

The VNIITF project team also has enlisted Pantex to assist VNIITF to develop an integrated system approach to maintenance. The Pantex Team performed an on site benchmarking tour at VNIITF, in February 1999. From the results of this visit, Pantex, in cooperation with LANL, will provide maintenance training to key VNIITF personnel on best Industry Maintenance Management Practices, in the near future. Follow on work with VNIITF will include the introduction of a site wide Maintenance Implementation Plan (MIP), to assist in assuring that the most important areas of maintenance are carried out and a Computerized Maintenance System (CMMS) to assist VNIITF in accomplishing this through an automated media system. The overall effect of this effort will be to increase sustainability, thus maintaining the MPC&A equipment in the highest state of readiness at VNIITF.

VNIITF is also acting as a general contractor for MPC&A upgrades at the Urals Electrochemical Integrated Plant (Sverdlovsk-44).

## **CONCLUSION**

A major MPC&A milestone was met at VNIITF when the MPC&A improvements were commissioned at the Pulse Research Reactor Facility in May, 1998. VNIITF has identified all the facilities for which MPC&A improvements will need to be made and MPC&A work has now started in several of the new more sensitive facilities. The US National Laboratories plan to cooperate with VNIITF to carry out MPC&A improvements and provide support, technical assistance, and equipment as needed to further the objectives of the program. VNIITF has taken the primary responsibility to provide the effort needed to improve their MPC&A system based upon their requirements. Several initiatives involving the VNIITF infrastructure have been undertaken to institutionalize the improvements and transfer them to other facilities both at VNIITF and at other Russian nuclear facilities.

## **ACKNOWLEDGMENT**

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